PREFACE

This document supersedes the South Florida Water Management District (SFWMD) Technical Publication 84-3 entitled "South Florida Water Management Documentation Report" which was released in February 1984. The text is divided into four parts: Model Overview, Functional Specifications, Model Specifications, and Miscellaneous Topics.

The model overview is presented in the first chapter where a general description of the South Florida Water Management Model is given. A short introduction to the model is followed by a history of its evolution from the 1970s to the present. The model is defined further in terms of its spatial extent and discretization, time discretization, and hardware requirements. Although the model is referred to as a hydrologic simulation model, it goes beyond simulating the components of the hydrologic cycle. In fact, the majority of the code written for the model deals with the complex operational and management aspects of the existing and proposed hydraulic infrastructure in the modeled area. A flowchart of the general logic in the model is presented.

Functional specifications refer to the discussion of the algorithms employed in both the hydrologic and management components of the model. Hydrologic processes such as rainfall, evapotranspiration, overland flow, subsurface flow and canal routing are discussed in Chapter 2. Chapter 3 deals with the operational aspects of the extensive system of canals, structures and pump stations that form the Central and Southern Florida Project for Flood Control and Other Purposes. The material is presented by geographical area. The different operating policies that apply in each area, together with their corresponding model implementations, are explained.

Model specifications which describe the programming aspect of the South Florida Water Management Model are presented in Chapters 4 and 5. Model input/output, program structure and individual function/subroutine descriptions are covered in those two chapters. A brief narrative of the available post-processing tools is given in the latter chapter.

Miscellaneous topics covered in Chapters 6 through 8 include calibration, sensitivity analysis and uncertainty analysis. Model calibration is used to reinforce the model's predictive capability by showing how well the simulated stage and discharge values match historical data. Results from a sensitivity analysis, expressed as correlation of model input parameter and model output, can be used as a guide during model calibration and as a tool for establishing priorities in future data collection activities. Uncertainty analysis provides the modeler and/or the decision-maker with confidence limits that express the variation in model output as a function of assumed confidence limits on the model input parameters.

The intent and purpose of this document require some clarifications. The model is constantly being improved. It is almost certain that any form of model documentation is outdated, in one way or another, at the time of its release. The reader should, therefore, be aware that the discussions in the following chapters pertain to version 2.10 of the model unless, otherwise, noted. Updates to this documentation may come in several forms: technical notes, memoranda or reports in printed and/or electronic format. An Internet Web page is under construction.

The South Florida Water Management Model is the most detailed, physically-based simulation model in existence that combines the hydrology and management aspects of a greater portion of the South Florida Water Management District. Several man-years of dedicated work were required to achieve the current status of the model. The model is regional in spatial extent because it covers a large area of substantial heterogeneity in both natural and managed hydrology. A 2-mile by 2-mile fixed resolution grid system makes the model large-scale. The model is site-specific because it was exclusively developed for the South Florida region. Expansion of the model boundary will require data and source code modifications depending on the hydrology and corresponding management of any new areas planned to be included.

In addition to simulating the natural hydrology in South Florida, the model also simulates the management processes that satisfy policy-based rules (both existing and proposed) to meet flood control, water supply and environmental needs. Daily continuous simulation, instead of event-based simulation, for 26 years using this type of distributed hydrologic model requires enormous computing power. The model has performed well in various applications using SunWorkstations™ running under the UNIX™ operating system. Prior to the current hardware/operating system configuration, the complexity and detail of the hydrology and hydraulics simulated by the model were very limited. The algorithms had to be simple, to accommodate available data, and practical, in order to make a model run within a reasonable amount of computer time. Current model applications require from six to ten hours to complete on SunWorkstations™. As of this writing, no plans have been made to make the model work across different platforms, e.g., VAX™ OS, Mac™ OS and Windows™.

Finally, this document is not intended to be a user's or programmer's manual. It should be used as a reference guide to the structure and algorithms of the model. Proficiency with the use of the model cannot be gained merely by reading this document. Extensive training is necessary to effectively define a problem, formulate a scenario, prepare input files, run the model, analyze the results and make sound recommendations. Running the model and interpreting the results without prior knowledge of the system are not recommended. The model domain encompasses a complex natural and managed hydrologic system and the system components are highly interdependent. Local changes within the regional system can have far-reaching impacts on the hydrology at other locations within the system. Evaluation of the impacts of proposed changes to the regional system is a complex and challenging task -- one that requires a thorough understanding and knowledge of the entire modeling domain. This documentation was prepared with a broad audience base in mind. The complexity of the system, and limited time and manpower preclude the inclusion of a user-friendly interface. Likewise, all of the possible detailed questions about the internal workings of the model are not addressed. Attempting to do so would require a similar amount of resources as were needed to develop and improve the model. Additional information regarding details of the model can be obtained from the SFWMD staff responsible for the continual development and application of the model.

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ABBREVIATIONS

ac-ft	acre-feet
AFSIRS	Agricultural Field -Scale Irrigation Requirements Simulation Model
ASCII	American Standard Code for Information Interchange
ASR	Aquifer Storage and Recovery or Aquifer Storage & Retrieval
BCNP	Big Cypress National Preserve
BMP	Best Management Practice
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers (same as USACE)
C&SF Project	Central and South Florida Flood Control Project
District	South Florida Water Management District (same as SFWMD)
DSS	Hydrologic Engineering Center's Data Storage System (same as HECDSS)
EAA	Everglades Agricultural Area
ENP	Everglades National Park
ENR Project	Everglades Nutrient Removal Project
EPA	Everglades Protection Area
ET	evapotranspiration
FAO	Food and Agriculture Organization
FGFWFC	Florida Game and Freshwater Fish Commission
ft	feet
GIS	Geographical Information System
HECDSS	Hydrologic Engineering Center's Data Storage System (same as DSS)
LEC	Lower East Coast
LECSA	Lower East Coast Service Area
LECRWSP	Lower East Coast Regional Water Supply Plan
LOK	Lake Okeechobee
LOSA	Lake Okeechobee Service Area
LWDD	Lake Worth Drainage District
MGD	million gallons per day
NESRS	Northeast Shark River Slough
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanographic and Atmospheric Administration
NSM	Natural System Model
PDE	Partial Differential Equation
SCS	Soil Conservation Service
SCCS	Source Code Control System
SDCS	South Dade Conveyance System
SRS	Shark River Slough
SFRSM	South Florida Regional Simulation Model
SFWMD	South Florida Water Management District (same as District)
SFWMM	South Florida Water Management Model
SSM	Supply-Side Management
STA	Stormwater Treatment Area

SWIM Plan	Surface Water Improvement and Management Plan
USACE	U.S. Army Corps of Engineers (same as Corps)
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCA	Water Conservation Area